

CLAIMS

I/We claim:

- [c1] 1. A microelectronic imaging unit, comprising: /
a microelectronic die including an image sensor, an integrated circuit electrically coupled to the image sensor, and a plurality of terminals electrically coupled to the integrated circuit;
a cover unit over the image sensor, the cover unit being a single, unitary component having a window and an integral side member projecting from the window, the side member being attached to the die; and
electrically conductive interconnects extending through the cover unit and/or the die, the interconnects being electrically coupled to corresponding terminals.
- [c2] 2. The microelectronic imaging unit of claim 1 wherein:
the die includes a first side, a second side opposite the first side, and a perimeter between the first side and the second side; and
the side member is attached to at least a portion of the perimeter of the die.
- [c3] 3. The microelectronic imaging unit of claim 1 wherein:
the die includes a first side and a second side opposite the first side,
the side member further includes a sealing face, the sealing face being attached to the first side of the die without any other portion of the side member contacting any other portion of the die.
- [c4] 4. The microelectronic imaging unit of claim 1 wherein:
the die includes a first side, a second side opposite the first side, and a perimeter between the first side and the second side; and

the cover unit encloses the first side of the die and at least a portion of the perimeter of the die, the cover unit being configured to seal the first side of the die and at least a portion of the perimeter of the die.

[c5] 5. The microelectronic imaging unit of claim 1 wherein:
the die includes a first side, a second side opposite the first side, and a perimeter between the first side and the second side;
the cover unit encloses at least a portion of the first side and the perimeter of the die; and
the imaging unit further comprises an encapsulant disposed on the second side of the die.

[c6] 6. The microelectronic imaging unit of claim 1 wherein:
the die includes a first side, a second side opposite the first side, and a perimeter between the first side and the second side;
the cover unit encloses at least a portion of the first side of the die without contacting or enclosing any portion of the perimeter of the die; and
the imaging unit further comprises an encapsulant disposed on at least a portion of (a) the second side of the die, (b) the perimeter of the die, and (c) the cover unit.

[c7] 7. The microelectronic imaging unit of claim 1, further comprising an optics unit having an optic member attached to the cover unit, and wherein the optic member is positioned at a desired location relative to the image sensor.

[c8] 8. The microelectronic imaging unit of claim 1 wherein the cover unit further comprises an optic member integral with the window and the side member, and wherein the optic member is positioned at a desired location relative to the image sensor.

[c9] 9. The microelectronic imaging unit of claim 1 wherein:
the individual interconnects have a first end portion and a second end portion spaced apart from the first end portion;
corresponding terminals are coupled to the first end portions of each interconnect; and
the imaging unit further comprises a plurality of ball-pads coupled to corresponding second end portions of the interconnects.

[c10] 10. The microelectronic imaging unit of claim 1 wherein:
the die includes a first side and a second side opposite the first side, wherein the terminals are at the first side of the die;
the individual interconnects have a first end portion coupled to corresponding terminals and a second end portion spaced apart from the first end portion; and
the imaging unit further comprises a plurality of ball-pads on the second side of the die coupled to corresponding second end portions of the interconnects.

[c11] 11. The microelectronic imaging unit of claim 1 wherein:
the cover unit further includes a first side facing the image sensor and a second side opposite the first side;
the individual interconnects have a first end portion and a second end portion spaced apart from the first end portion;
corresponding terminals are coupled to the first end portions of each interconnect; and
the imaging unit further comprises a plurality of ball-pads on the second side of the cover unit coupled to corresponding second end portions of the interconnects.

[c12] 12. The microelectronic imaging unit of claim 1 wherein the interconnects extend through the die.

- [c13] 13. The microelectronic imaging unit of claim 1 wherein the interconnects extend through the cover unit.
- [c14] 14. The microelectronic imaging unit of claim 1 wherein the cover unit includes at least one of glass, quartz, or other materials transmissive to a desired spectrum of radiation.
- [c15] 15. A microelectronic imaging unit, comprising:
a microelectronic die including an image sensor, an integrated circuit electrically coupled to the image sensor, and a plurality of terminals electrically coupled to the integrated circuit;
a cover unit over the image sensor, the cover unit having a window and a side member projecting from the window, the side member and the window being separate components and the side member being attached to the die; and
electrically conductive interconnects electrically coupled to corresponding terminals and extending through the cover unit and/or the die.
- [c16] 16. The microelectronic imaging unit of claim 15 wherein:
the die includes a first side, a second side opposite the first side, and a perimeter between the first side and the second side; and
the side member is attached to at least a portion of the perimeter of the die.
- [c17] 17. The microelectronic imaging unit of claim 15 wherein:
the die includes a first side, a second side opposite the first side, and a perimeter between the first side and the second side; and
the cover unit encloses the first side of the die and at least a portion of the perimeter of the die, the cover unit being configured to seal the first side of the die and at least a portion of the perimeter of the die.

- [c18] 18. The microelectronic imaging unit of claim 15 wherein:
the die includes a first side, a second side opposite the first side, and a
perimeter between the first side and the second side;
the cover unit encloses at least a portion of the first side and the perimeter
of the die; and
the imaging unit further comprises an encapsulant disposed on the second
side of the die.
- [c19] 19. The microelectronic imaging unit of claim 15, further comprising an
optics unit having an optic member attached to the cover unit, and wherein the
optic member is positioned at a desired location relative to the image sensor.
- [c20] 20. The microelectronic imaging unit of claim 15 wherein the cover unit
further comprises an optic member integral with the window and the side member,
and wherein the optic member is positioned at a desired location relative to the
image sensor.
- [c21] 21. The microelectronic imaging unit of claim 15 wherein:
the die includes a first side and a second side opposite the first side,
wherein the terminals are at the first side of the die;
the individual interconnects have a first end portion coupled to
corresponding terminals and a second end portion spaced apart from
the first end portion; and
the imaging unit further comprises a plurality of ball-pads on the second
side of the die coupled to corresponding second end portions of the
interconnects.
- [c22] 22. The microelectronic imaging unit of claim 15 wherein:
the die includes a first side and a second side opposite the first side,
wherein the terminals are at least proximate to the first side of the
die;

the individual interconnects have a first end portion coupled to corresponding terminals and a second end portion spaced apart from the first end portion; and
the imaging unit further comprises a plurality of ball-pads on the second side of the die coupled to corresponding second end portions of the interconnects.

[c23] 23. The microelectronic imaging unit of claim 15 wherein the interconnects extend through the die.

[c24] 24. The microelectronic imaging unit of claim 15 wherein the interconnects extend through the cover unit.

[c25] 25. The microelectronic imaging unit of claim 15 wherein the window and the side member include at least one of glass, quartz, or other materials transmissive to a desired spectrum of radiation.

[c26] 26. A microelectronic imaging unit, comprising:
a microelectronic die having a first side, a second side opposite the first side, and a perimeter having end surfaces;
an image sensor on the first side of the die;
an integrated circuit in the die and electrically coupled to the image sensor;
a plurality of bond-pads on the first side of the die and electrically coupled to the integrated circuit;
a cover unit over the image sensor, the cover unit being a single, unitary component having a window and a side member projecting from the window, and the side member being attached to the die; and
electrically conductive interconnects electrically coupled to corresponding bond-pads and extending through the cover unit and/or the die.

[c27] 27. The microelectronic imaging unit of claim 26 wherein the side member is attached to at least a portion of the perimeter of the die.

[c28] 28. The microelectronic imaging unit of claim 26 wherein the side member further includes a sealing face, the sealing face being attached to the first side of the die without any other portion of the side member contacting any other portion of the die.

[c29] 29. The microelectronic imaging unit of claim 26 wherein the cover unit encloses the first side of the die and at least a portion of the perimeter of the die, the cover unit being configured to seal the first side of the die and at least a portion of the perimeter of the die.

[c30] 30. The microelectronic imaging unit of claim 26 wherein:
the cover unit encloses at least a portion of the first side and the perimeter of the die; and
the imaging unit further comprises an encapsulant disposed on the second side of the die.

[c31] 31. The microelectronic imaging unit of claim 26 wherein:
the cover unit encloses at least a portion of the first side of the die without contacting the perimeter of the die; and
the imaging unit further comprises an encapsulant disposed on at least a portion of (a) the second side of the die, (b) the perimeter of the die, and (c) the cover unit.

[c32] 32. The microelectronic imaging unit of claim 26, further comprising an optics unit having an optic member attached to the cover unit, and wherein the optic member is positioned at a desired location relative to the image sensor.

[c33] 33. The microelectronic imaging unit of claim 26 wherein the cover unit further comprises an optic member integral with the window and the side member, and wherein the optic member is positioned at a desired location relative to the image sensor.

[c34] 34. The microelectronic imaging unit of claim 26 wherein:
the individual interconnects have a first end portion coupled to corresponding terminals and a second end portion spaced apart from the first end portion; and
the imaging unit further comprises a plurality of ball-pads coupled to corresponding second end portions of the interconnects.

[c35] 35. The microelectronic imaging unit of claim 26 wherein:
the individual interconnects have a first end portion coupled to corresponding terminals and a second end portion spaced apart from the first end portion; and
the imaging unit further comprises a plurality of ball-pads on the second side of the die coupled to corresponding second end portions of the interconnects.

[c36] 36. The microelectronic imaging unit of claim 26 wherein:
the cover unit further includes a first side facing the image sensor and a second side opposite the first side;
the individual interconnects have a first end portion coupled to corresponding terminals and a second end portion spaced apart from the first end portion; and
the imaging unit further comprises a plurality of ball-pads on the second side of the cover unit coupled to corresponding second end portions of the interconnects.

[c37] 37. The microelectronic imaging unit of claim 26 wherein the interconnects extend through the die.

[c38] 38. The microelectronic imaging unit of claim 26 wherein the interconnects extend through the cover unit.

[c39] 39. The microelectronic imaging unit of claim 26 wherein the cover unit includes at least one of glass, quartz, or other materials transmissive to a desired spectrum of radiation.

[c40] 40. A plurality of microelectronic imagers, comprising:
a microfeature workpiece including a plurality of microelectronic dies, the individual dies having an image sensor, an integrated circuit electrically coupled to the image sensor, and a plurality of bond-pads electrically coupled to the integrated circuit;
a plurality of cover units over corresponding image sensors, the cover units being single, unitary components having a window and a side member integral with and projecting from the window, the individual side members being attached to corresponding individual dies; and
electrically conductive interconnects extending through the individual cover units and/or individual dies and electrically coupled to corresponding terminals.

[c41] 41. The microelectronic imagers of claim 40 wherein:
the individual dies include a first side, a second side opposite the first side, and a perimeter between the first side and the second side; and
the individual side members are attached to at least a portion of the perimeter of the individual dies.

- [c42] 42. The microelectronic imagers of claim 40 wherein:
the individual dies includes a first side and a second side opposite the first side,
the individual side members further include a sealing face attached to the first side of the individual die without any other portion of the individual cover units contacting any other portion of the individual dies.
- [c43] 43. The microelectronic imagers of claim 40 wherein:
the individual dies includes a first side, a second side opposite the first side, and a perimeter between the first side and the second side; and
the individual cover units enclose the first side of the individual dies and at least a portion of the perimeter of the individual dies, the individual cover units being configured to seal the first side and at least a portion of the perimeter of the individual dies.
- [c44] 44. The microelectronic imagers of claim 40, further comprising a plurality of optics unit having optic members attached to the individual cover units, and wherein the individual optic members are positioned at a desired location relative to the individual image sensor.
- [c45] 45. The microelectronic imagers of claim 40 wherein the individual cover units further comprise an optic member integral with the window and the side member, and wherein the individual optic members are positioned at a desired location relative to the individual image sensors.
- [c46] 46. A method of packaging a microelectronic imager, comprising:
providing a microelectronic die having an image sensor, an integrated circuit electrically coupled to the image sensor, and a plurality of terminals electrically coupled to the integrated circuit;

providing a cover unit having a window and a side member projecting from and integral with the window;
attaching the cover unit to the die over the image sensor; and
forming a plurality of electrically conductive interconnects electrically coupled to corresponding terminals and extending through the die and/or the cover unit.

[c47] 47. The method of claim 46 wherein:
the die includes a first side, a second side opposite the first side, and a perimeter between the first side and the second side; and
attaching the cover unit to the die includes attaching the side member to at least a portion of the perimeter of the die.

[c48] 48. The method of claim 46 wherein:
the die includes a first side and a second side opposite the first side;
the side member further includes a sealing face; and
attaching the cover unit to the die includes attaching the sealing face to the first side of the die without any other portion of the side member contacting any other portion of the die.

[c49] 49. The method of claim 46 wherein:
the die includes a first side, a second side opposite the first side, and a perimeter between the first side and the second side; and
attaching the cover unit to the die includes enclosing and sealing the first side of the die and at least a portion of the perimeter of the die with the cover unit.

[c50] 50. The method of claim 46 wherein:
the die includes a first side, a second side opposite the first side, and a perimeter between the first side and the second side;

attaching the cover unit to the die includes enclosing at least a portion of the first side and the perimeter of the die with the cover unit; and the method further comprises disposing an encapsulant on the second side of the die.

[c51]

51. The method of claim 46 wherein:
the die includes a first side, a second side opposite the first side, and a perimeter between the first side and the second side;
attaching the cover unit to the die includes enclosing at least a portion of the first side of the die with the cover unit without contacting or enclosing any portion of the perimeter of the die; and
the method further comprises disposing an encapsulant on at least a portion of (a) the second side of the die, (b) the perimeter of the die, and (c) the cover unit.

[c52]

52. The method of claim 46, further comprising attaching an optics unit having an optic member to the cover unit, wherein the optic member is positioned at a desired location relative to the image sensor.

[c53]

53. The method of claim 46 wherein providing a cover unit further comprises providing a single unitary member cover unit.

[c54]

54. The method of claim 46 wherein providing a cover unit further comprises providing a single unitary member cover unit including an optic member integral with the window and the side member, wherein the optic member is positioned at a desired location relative to the image sensor.

[c55]

55. The method of claim 46 wherein:
the individual electrically conductive interconnects have a first end portion and a second end portion spaced apart from the first end portion;

the method further comprises coupling corresponding terminals to the first end portions of each interconnect; and

the imaging unit further comprises a plurality of ball-pads, wherein corresponding ball-pads are coupled to the second end portions of each interconnect.

[c56] 56. The method of claim 46, further comprising providing an optics unit having an optic member, and wherein the optics unit is attached to the cover unit with the optic member positioned at a desired location relative to the image sensor.

[c57] 57. A method of packaging a plurality of microelectronic imagers, comprising:

providing a microfeature workpiece including a plurality of microelectronic dies, the individual dies having an image sensor, an integrated circuit electrically coupled to the image sensor, and a plurality of bond-pads electrically coupled to the integrated circuit;

providing a plurality of cover units, the cover units being single, unitary components having a window and a side member;

attaching individual cover units to individual dies over corresponding image sensors; and

forming a plurality of electrically conductive interconnects extending through individual dies and/or cover units and electrically coupled to corresponding bond-pads.

[c58] 58. The method of claim 57 wherein:

the individual dies includes a first side, a second side opposite the first side, and a perimeter between the first side and the second side; and

attaching individual cover units to individual dies includes attaching individual side members to corresponding perimeters of the individual dies.

[c59]

59. The method of claim 57 wherein:
the individual dies includes a first side, a second side opposite the first side,
and a perimeter between the first side and the second side; and
attaching individual cover units to individual die includes enclosing and
sealing the first side of the individual dies and at least a portion of the
perimeter of the individual dies with the individual cover units.

[c60]

60. The method of claim 57, further comprising attaching individual
optics units having optic members to corresponding cover units, wherein the
individual optic members are positioned at a desired location relative to
corresponding image sensors.